

Pend Oreille River Temperature TMDL

Introduction

- History of the TMDL
- Basic Introduction to Daily Comparison and Cumulative Frequency Analysis (CFA)
- Exceedences Using the Different Methods
- Specific Issues
 - Daily Maximum Criteria
 - State Line Heat Loading
 - Tribal WQS and Sovereignty
 - Reasons Ecology chose CFA
 - Data Pooling Period
 - Use of CFA with Interdependent Data

TMDL History

- **2004 - 2007** EPA, Kalispel Tribe, States of Washington and Idaho collaborate on TMDL
- **May 2004** –MOA between States, Tribe and EPA signed
- **2005** - EPA awards \$105,000 in grants and contracts to the Tribe for work relating to TMDL
- **July 2007** Draft Interjurisdictional TMDL shared with stakeholders
- **July 2007 – December 2009**
 - States address stakeholder comments on TMDL
 - EPA - Ecology discourse on WQS interpretation
 - Washington moves forward with TMDL using CFA
- **January 2009 - August 2010** - Two staff meetings between EPA & Kalispel Tribe
- **Fall 2010** – Draft Washington TMDL out for public comment
- **January 2011** Third staff meeting between EPA and Kalispel Tribe

TMDL History

- **Spring 2011** EPA letter to Kalispel Tribe offering consultation; Tribe accepts
- **April 2011** Ecology submits TMDL to EPA; Dam operators request dispute resolution & file lawsuits
- **Summer 2011** Consultation between RA & Tribal Chairman at reservation, followed by RA letter
- **August 2011** Dispute Resolution Process completed;
- **November 2011** Ecology submits final TMDL; Fourth Meeting between EPA & Tribal staff
- **February 2012** Phone conversation and follow up letter from Office of Water Director, Mike Bussell to Deane Osterman at Kalispel Tribe Natural Resources Department
- **Spring Summer 2012** – 2 FOIAs and FOIA appeal by Tribe
- **July 2012** – HQ meeting with Tribe

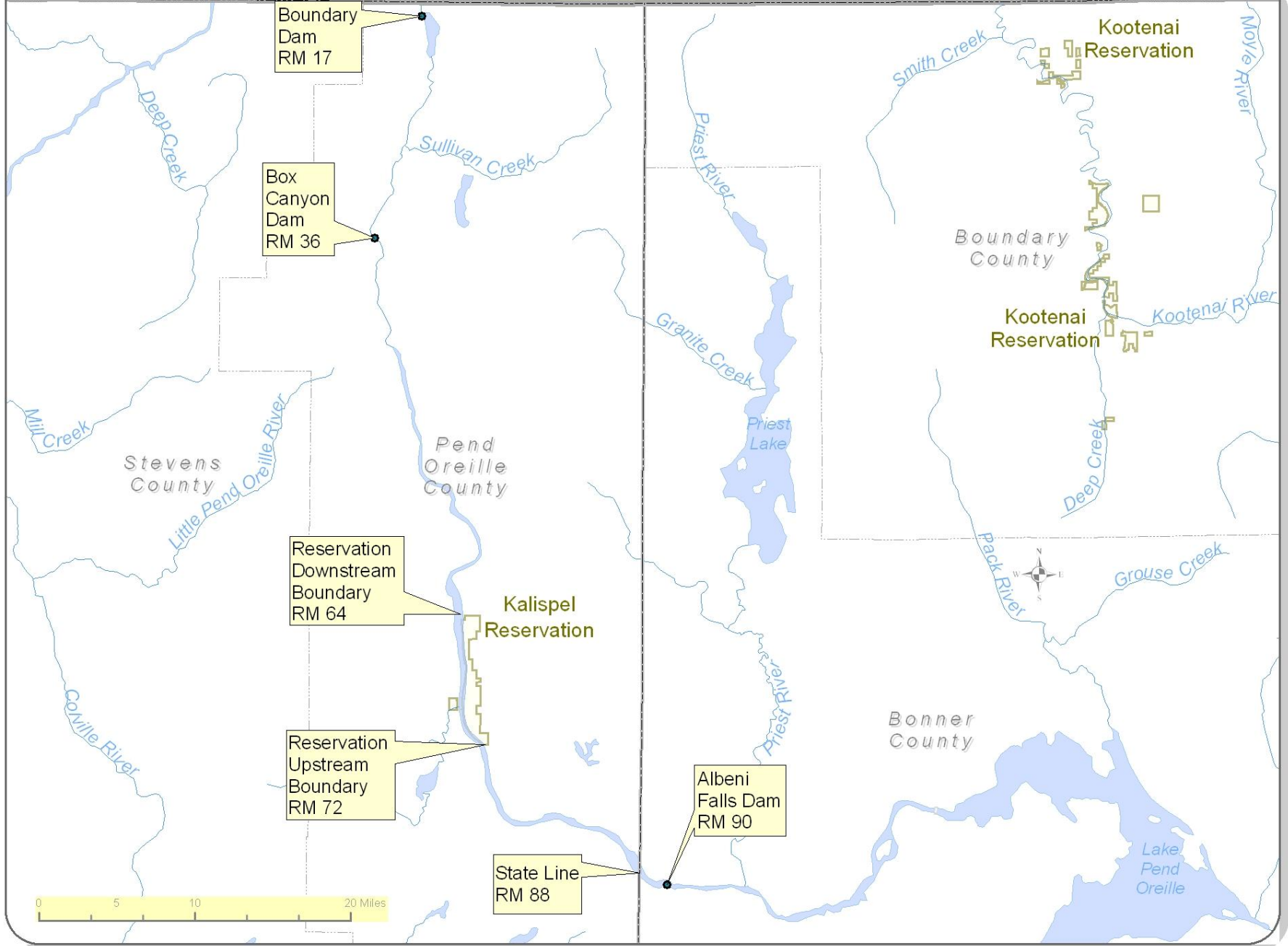
2004 Pend Oreille River TMDL MOA

- The Tribe contends the MOA fell apart under pressure from the regulated community and that EPA and Ecology catered to the dam operators and ignored the Tribe's interests
- Ecology rejected vertical (volume) averaging of temperatures in the impoundment and interpreted standards against the views of the dam operators
- The dam operators were not pleased with the TMDL – initiating dispute resolution and lawsuits upon its issuance
- EPA Supported Tribe's interests with regard to TMDL:
 - Provided the Tribe with \$105,000 in grant and contract funding for work related to the TMDL
 - Negotiated for over a year with Ecology to reverse a Pend Oreille River standards interpretation that was opposed by the Tribe
 - Successfully intervened on proposed changes to TMDL from dispute resolution process in response to Tribe's comments
 - There have been two major issues between the tribe and Ecology in this TMDL. EPA has sided with the tribe on one major issue (WQS interpretation) and with Ecology on the other (model output analysis).

Partial Attainment of 2004 MOA

- Though the entities signing the MOA felt collaboration was desirable, the MOA was not a binding agreement, and all parties understood this
- The collaboration that occurred under the MOA was invaluable to all parties – building models that are based on consistent assumptions and data, forming a strong technical basis for the TMDL
- The MOA was only partially completed (no interjurisdictional TMDL) due to loss of funding in Idaho and this dispute between Ecology and the Tribe

British Columbia



What Does the Tribe Want?

- Tribe has represented that they are satisfied with measures at Boundary and Box Canyon Dams
- Because of location – Boundary Dam does not have temperature effects on reservation waters
- Box Canyon Dam– Tribe is satisfied with measures
- Primary Issue: Albeni Falls Dam and determination of heat loading at state line
- Interest in using the TMDL to leverage discussions with the Corps re: Albeni Falls Dam

Kalispel Tribe Support from Dam Operators

- Seattle City Light (Boundary Dam)
- 4/09 - Under the FERC license Pend Oreille PUD (Box Canyon Dam) will spend \$250 million for restoration and mitigation including
 - Spend more than \$50 million on a fish passage facility. It must remove nonnative fish and reintroduce desirable trout species.
 - Restore trout habitat on 164 miles of rivers and streams that flow into the Pend Oreille River over the next 25 years.
 - Develop a plan to improve recreation facilities on the reservoir, and provide money for the tribe to build recreation facilities at the Pow Wow Grounds, Kalispel Boat Launch and Manresa Grotto Beach.
- 7/ 2012 - \$39.5 million - 10 year agreement with BPA, USBR & USACE focused on actions to address impacts of Albeni Falls Dam on fish and wildlife

Tribe's Objections to CFA

- Cannot be used to determine compliance with daily maximum criteria that are part of the State and Tribal WQS
- Masks the quantity and magnitude of temperature exceedences, in particular at the Idaho border and in Tribal waters
- It is being used in a technically inappropriate way
 - Only appropriate to use where data are random and not interdependent
 - Excessive pooling periods should not be used for short term time lag effects
- Is unacceptable for meeting the Kalispel standards in Tribe's waters
 - Violates Tribe's sovereignty
 - Does not meet downstream waters standards
- Is applied for non scientific reasons - benefit polluters

Daily Comparison Method

- The model divides the river into segments along its length
- Data generated for each segment on half hour intervals for 2004 and 2005
- There are two (relevant) model runs
 - a Natural Conditions simulation without the dams
 - an Existing Conditions simulation
- Each simulation has data for every segment and every half hour over the two years modeled
- Daily Comparison Method compares the maximum daily temperature from the Existing Conditions simulation to data from the same time and location in the Natural Conditions simulation – the difference is the magnitude of impairment

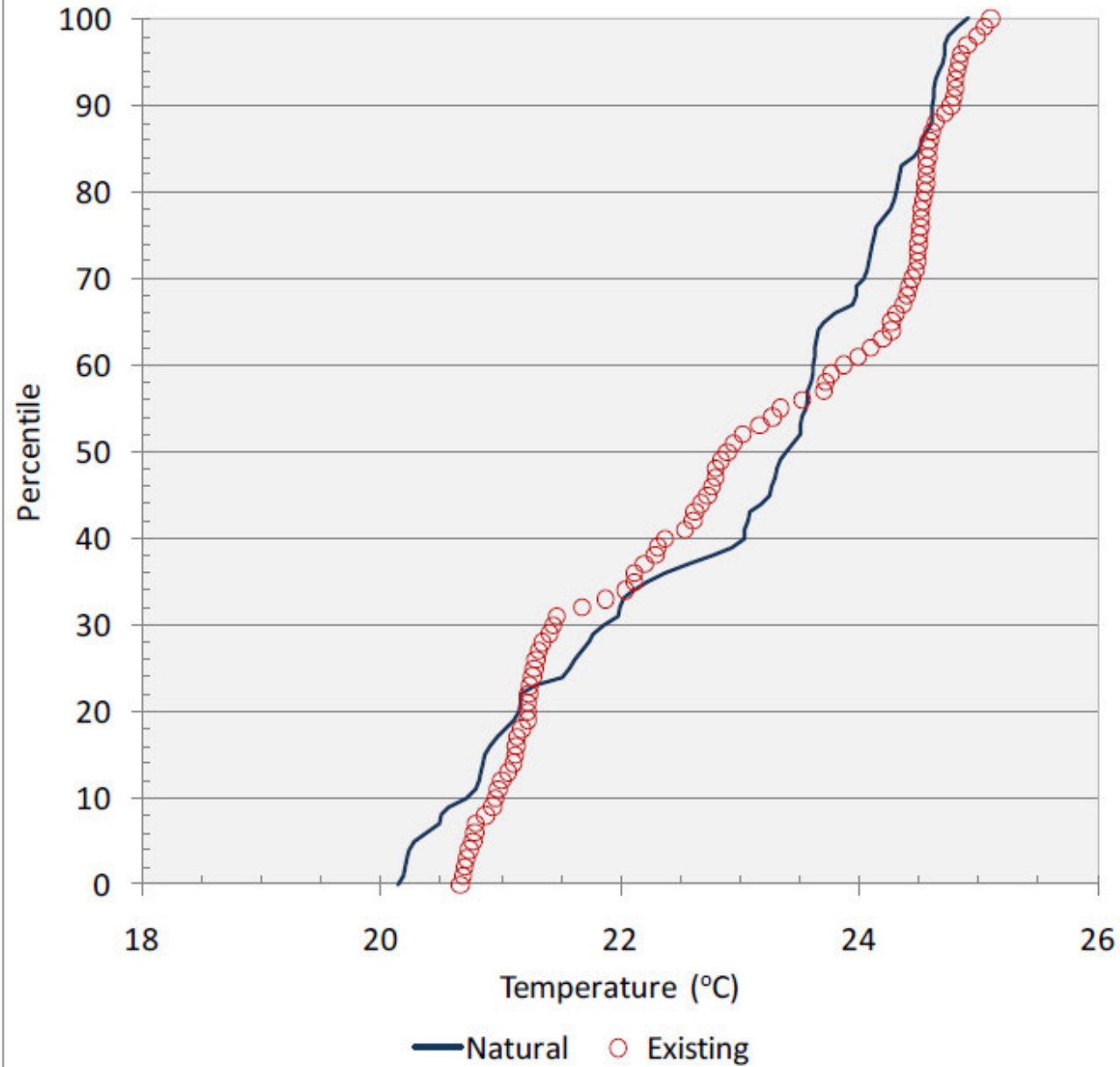
Cumulative Frequency Analysis

- CFA is a statistical analysis of two data sets
- Data distributions are compared at each rank percentile value (frequency of occurrence in the data pool)
- One cannot do a cumulative frequency analysis without first aggregating (pooling) the data

CFA in TMDL

- The daily maximum data points in the existing conditions simulation that exceed each criteria were pooled (about 62 days)
- The corresponding data points (same location, same time) in the natural conditions simulation were also pooled
- These pools of data were then plotted by cumulative frequency of occurrence in the data set

Lower Skookum Reach - 2004
1-Day Maximum

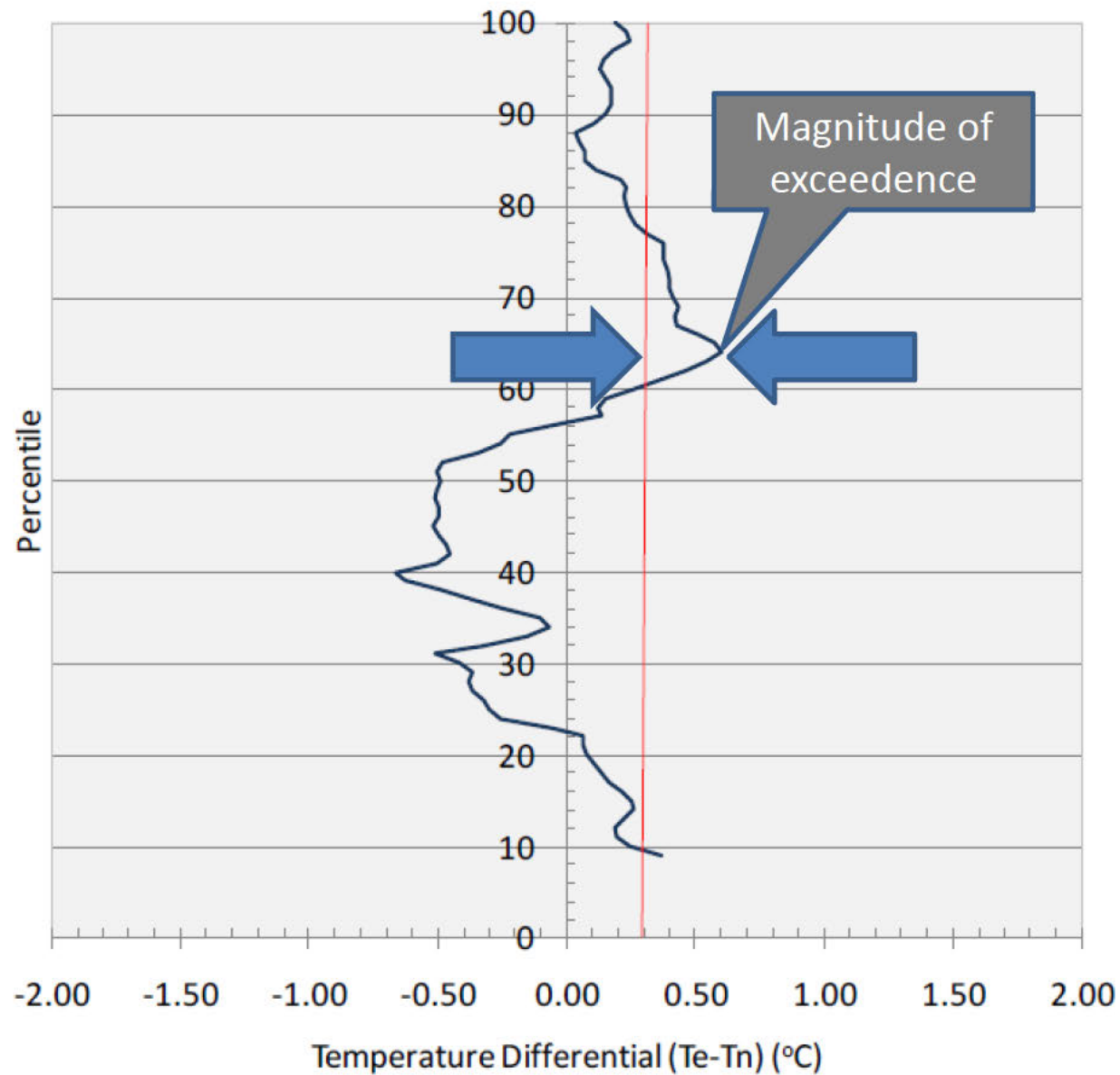


CFA in TMDL

- Once the two sets of data were plotted by cumulative frequency of occurrence, data points of the same rank in each data set were subtracted from each other.
- This difference was then plotted on the same vertical (frequency of occurrence) axis
- The vertical center line is zero difference
- The red line is the 0.3 C human use allowance in the state's natural conditions criteria

Lower Skookum Reach - 2004

1-Day Maximum

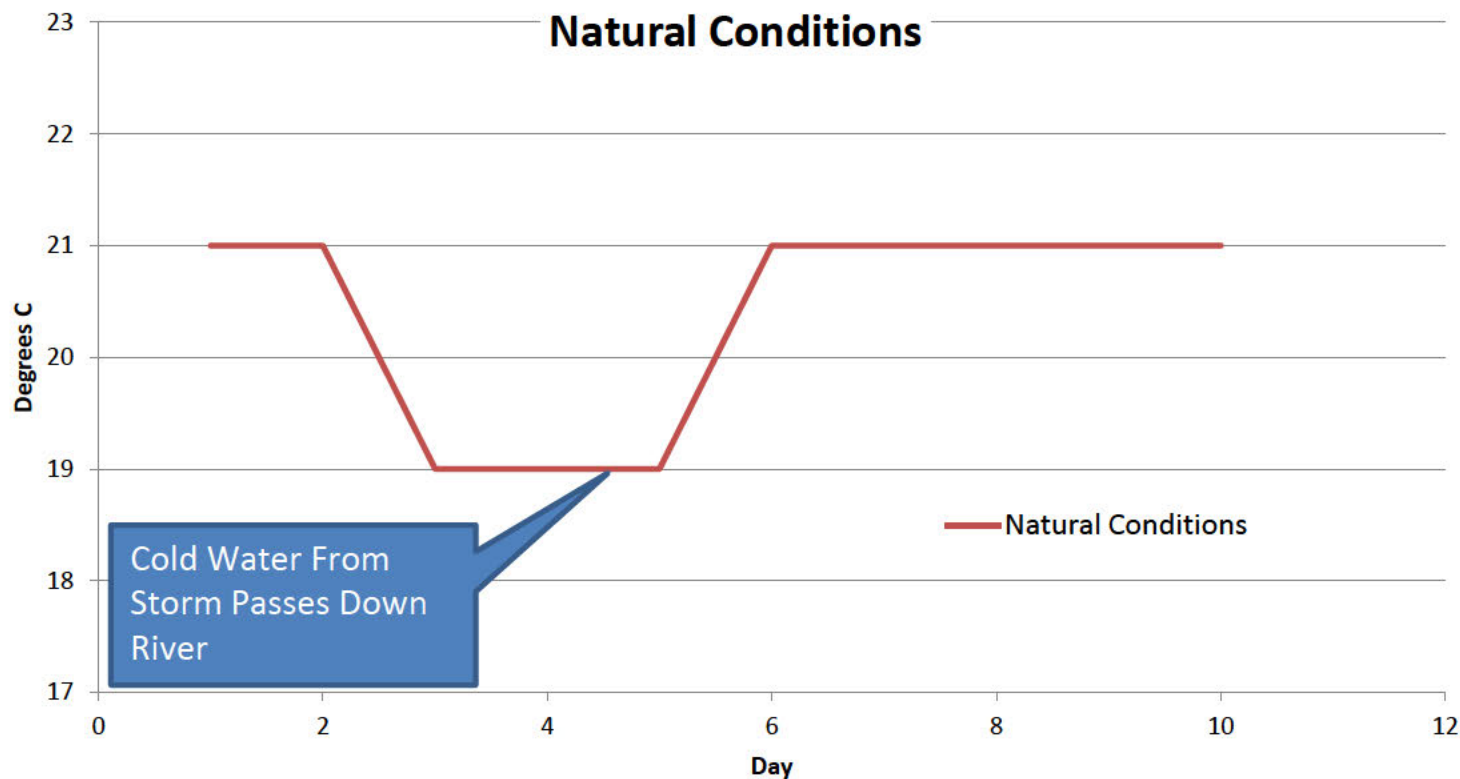


Time Lag

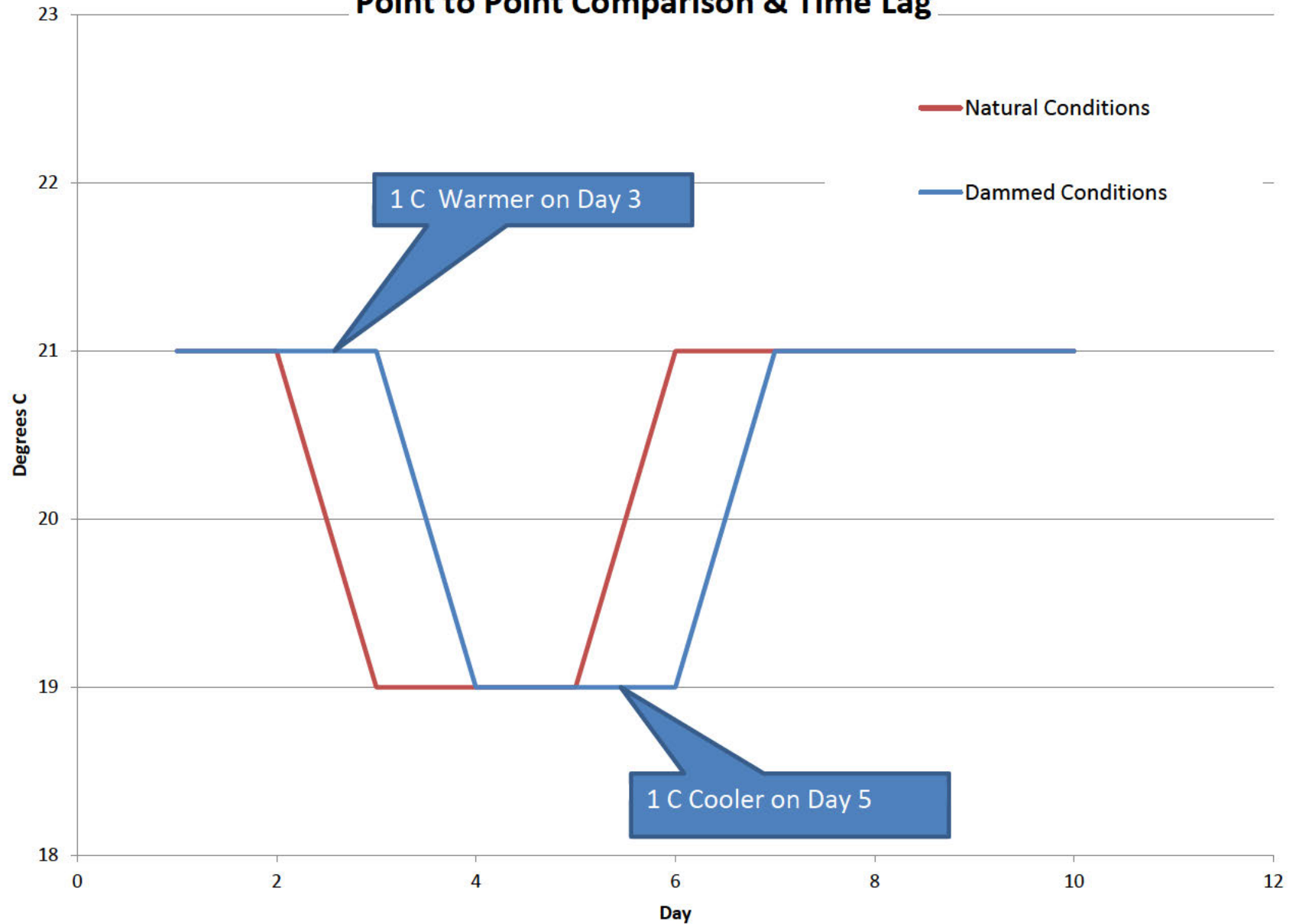
- Dams slow the travel time of water downstream
- In model simulations with dams in place (existing conditions) the same pulse of water will pass a location later than it will in the undammed (natural conditions) scenario.
- Comparing data points from the same time and place between the two model simulations can result in an brief exceedence of the criteria due to a cool pulse of water moving downstream

Time Lag

- If there is a storm upstream in the mountains a pulse of cool water will flow down the river



Point to Point Comparison & Time Lag



CFA in the TMDL

- Ecology changed the model data analysis method from daily comparison to CFA for these reasons:
 - CFA allowed for the comparison of different hydrologic conditions by minimizing differences in volume and flow as a result of hydroelectric facility operation
 - CFA minimized the effect of short-term events such as weather fronts
 - CFA provided a way to determine how often temperatures of a given magnitude occur within a specific amount of time
- Temperatures are estimated from a model. There are uncertainties in these estimates, and this is another reason model results are often aggregated over time and space to provide a more generalized assessment with greater confidence.

Washington's 20 C Daily Maximum Criterion

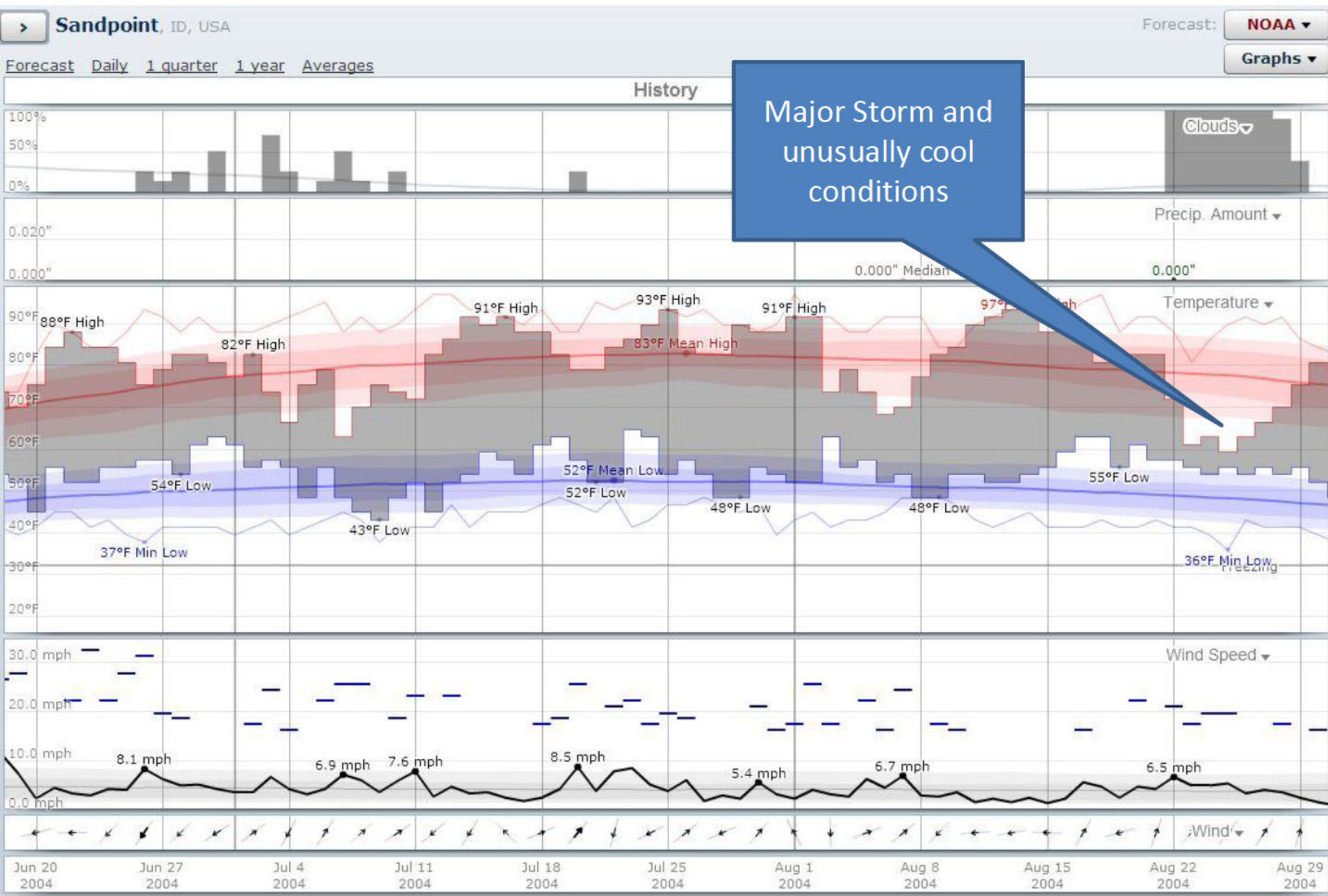
- Temperature shall not exceed a 1-day maximum (1-DMax) of 20°C due to human activities.
- When natural conditions exceed a 1-DMax of 20°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C;
- WAC 173-201A-200

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Weather Data

- Evidence from all climate stations used in model shows 90% cloud cover, high precipitation and unusually cool conditions between August 22 and 29, 2004, when half of the exceedences occurred
- Deer Park, Newport, Felts Field, and Tacoma Creek stations show storm conditions on June 30, 2004
- Local stations show some rain fall on June 24, 2004



Kalispel Standards also have a Daily Maximum Criteria:

- 1) Temperature shall not exceed 18°C as a moving 7-day average of the daily maximum temperatures with no single daily maximum temperature greater than 20.5°C.
- When natural background conditions prevent the attainment of the numeric temperature criteria, human-caused conditions and activities considered cumulatively can increase temperature levels by only an additional 0.3°C.
- 12 b (1) Kalispel Tribal Water Quality Standards

Kalispel 20.5 C Daily Maximum Criteria

- The TMDL looked at segments 115 and 172, upstream and downstream of Kalispel Tribal waters to assess how to meet the Tribe's WQS and called for a 0.29 C reduction in this area
- Using Daily Comparison the 20.5 C maximum was exceeded 224 times in these segments over the two years
 - In 8 of these instances the daily maximum criteria applied
 - 5 exceeded the 0.29 C reduction the TMDL calls for at the Kalispel border.
 - The average exceedence over the called for reduction was 0.37 C; the maximum exceedence was 0.54 C

Stateline Temperature Loading

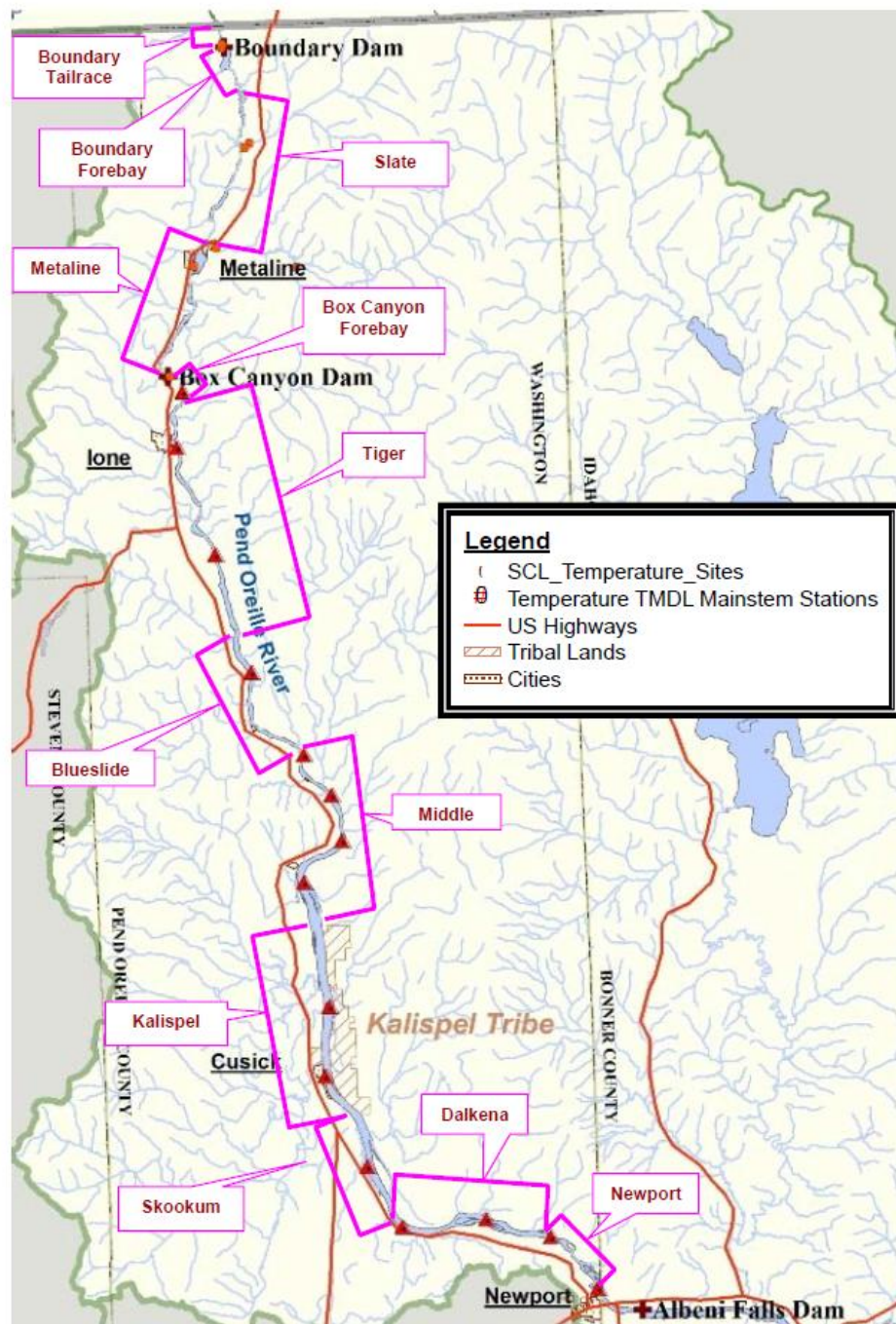
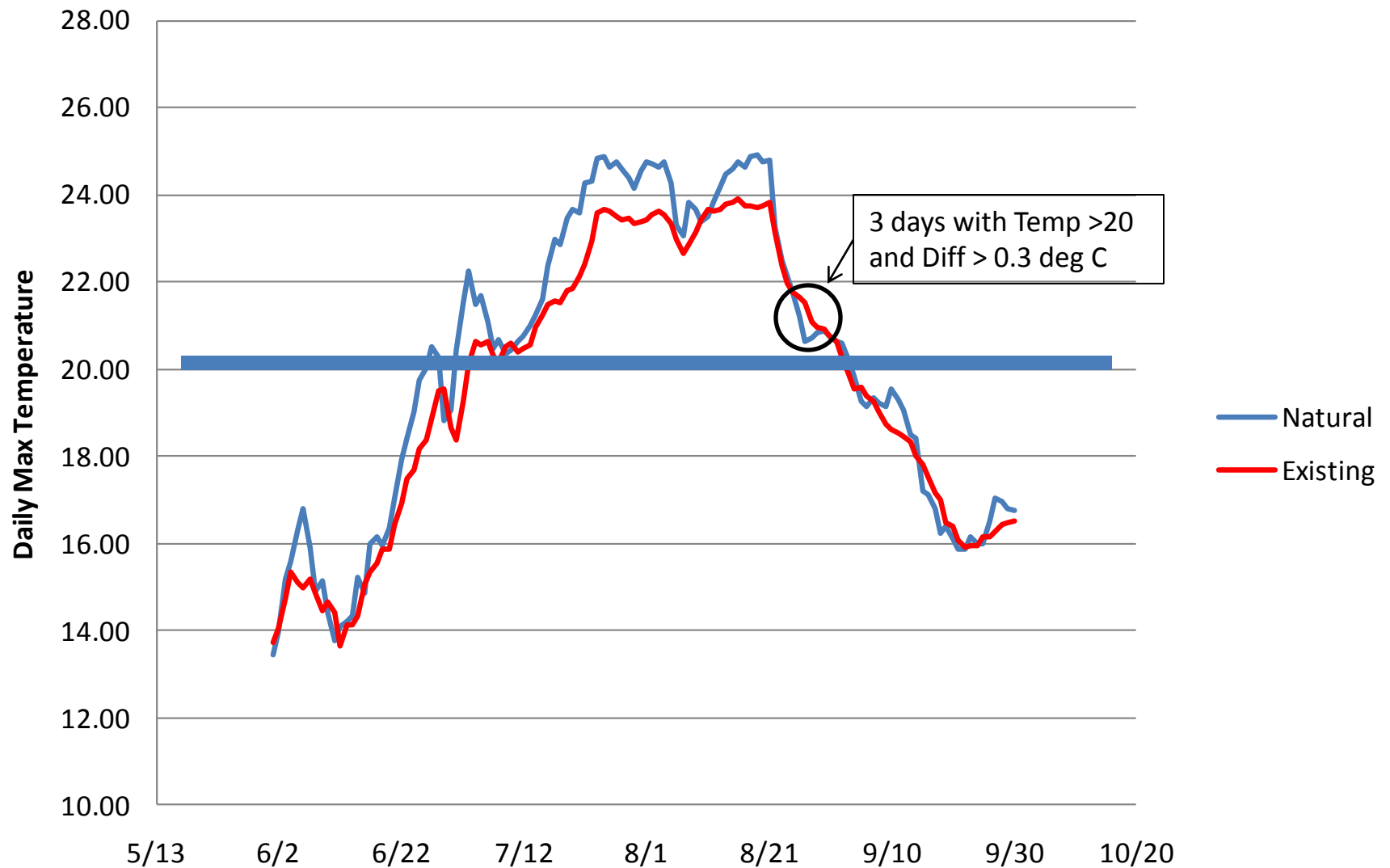


Figure 7. Pend Oreille River reaches and monitoring locations.

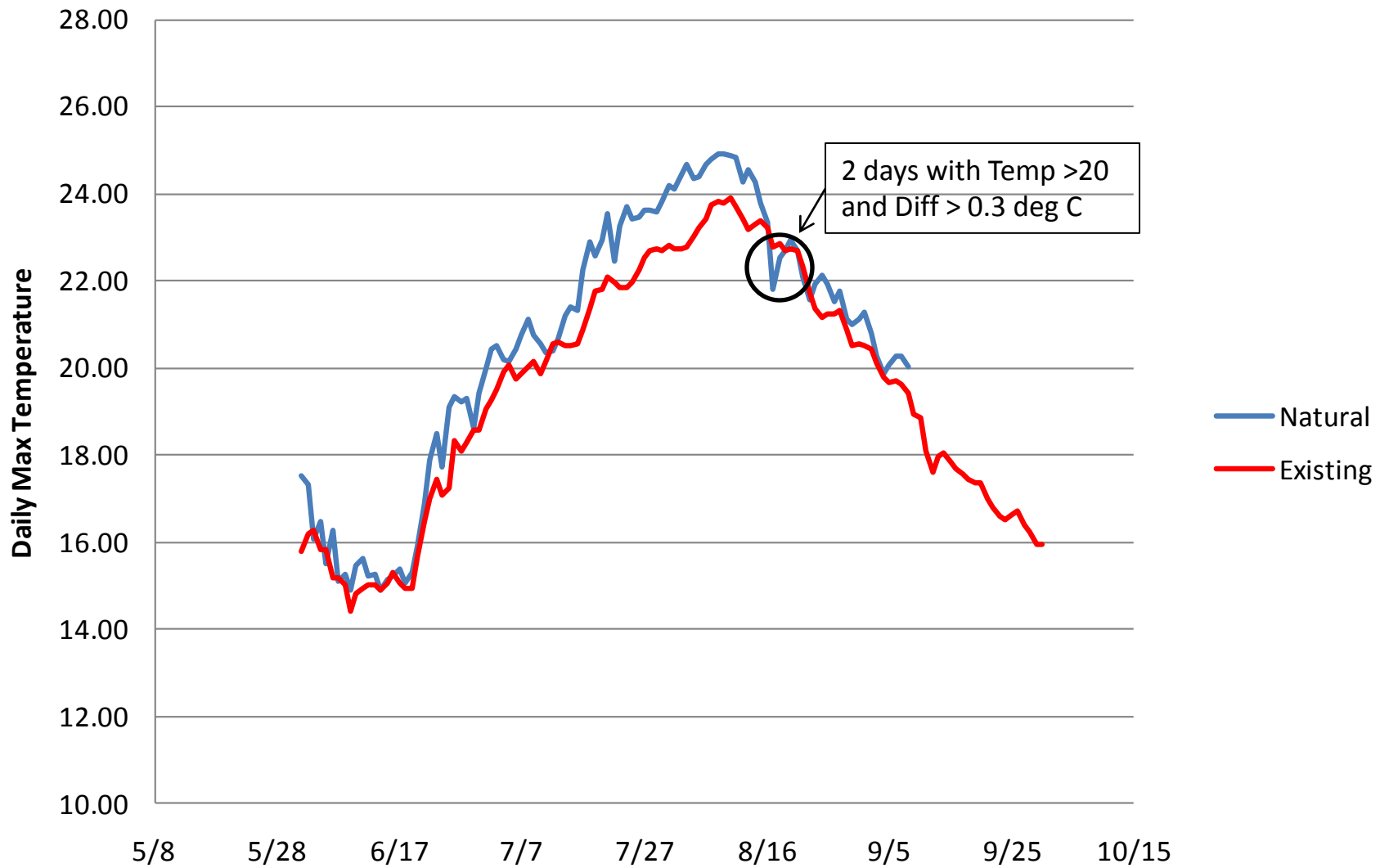
2004

At State Line



2005

At State Line



Albeni Falls Dam

- Kalispel Tribe makes two assertions
 - (1) State line is impaired based on the “correct” analytical method
 - (2) On days when tribal standards are exceeded (downstream of border in tribal waters), Albeni is contributing heat to the river.
 - Therefore, Albeni should be assigned a TMDL allocation

Time series model output

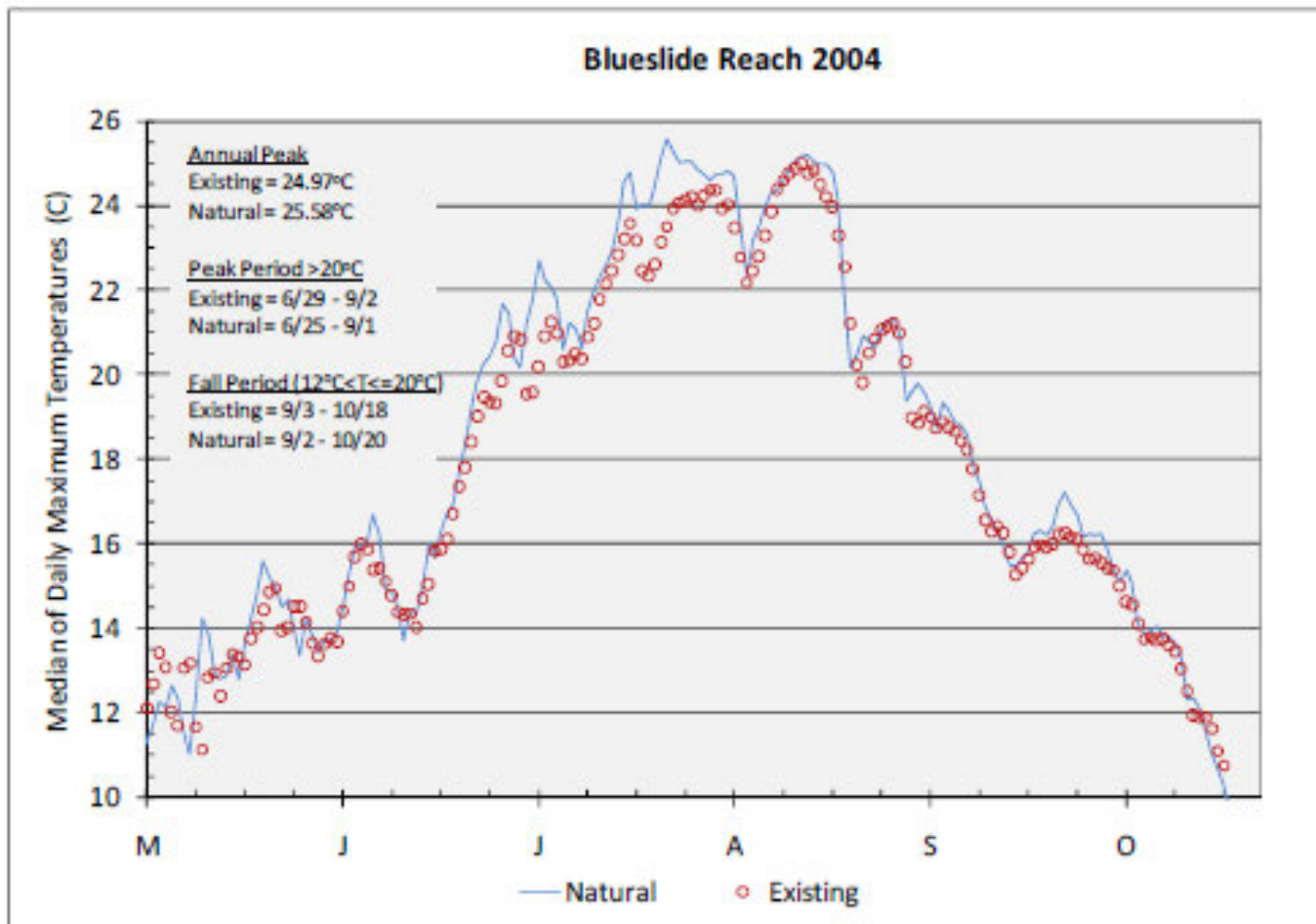
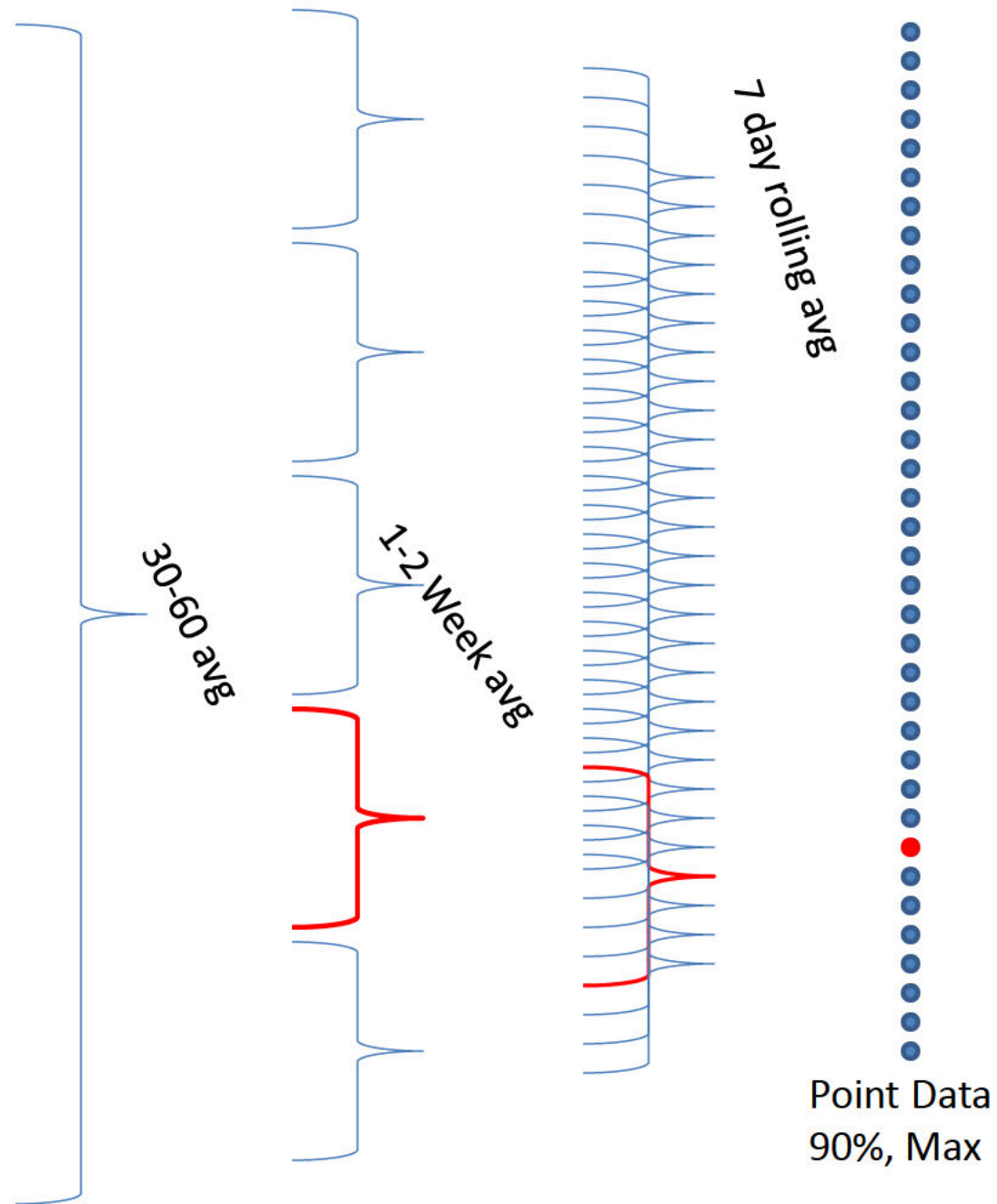


Figure 8. Modeled natural and existing median daily maximum temperatures for the Blueslide reach in 2004.

Date Natural Existing Diff

06/30/05	19.41	18.58	-0.83
07/01/05	19.98	19.07	-0.91
07/02/05	20.43	19.27	-1.17
07/03/05	20.51	19.52	-0.99
07/04/05	20.19	19.90	-0.29
07/05/05	20.16	20.05	-0.10
07/06/05	20.43	19.75	-0.69
07/07/05	20.76	19.87	-0.89
07/08/05	21.11	20.03	-1.09
07/09/05	20.74	20.13	-0.60
07/10/05	PAIRED ANALYSIS	20.68	0.68
07/11/05		20.20	0.20
07/12/05	20.39	20.55	0.16
07/13/05	20.69	20.58	-0.11
07/14/05	21.19	20.52	-0.67
07/15/05	21.39	20.53	-0.86
07/16/05	21.31	20.57	-0.74
07/17/05	22.25	20.88	-1.38
07/18/05	22.90	21.37	-1.52
07/19/05	22.59	21.78	-0.81
07/20/05	22.96	21.80	-1.16
07/21/05	23.52	22.08	-1.45
07/22/05	22.44	21.95	-0.49
07/23/05	23.28	21.83	-1.45
07/24/05	23.71	21.85	-1.86
07/25/05	23.43	21.97	-1.47
07/26/05	23.46	22.26	-1.20
07/27/05	23.64	22.52	-1.12
07/28/05	23.62	22.69	-0.93
07/29/05	23.60	22.72	-0.88



Rank Natural Existing Diff

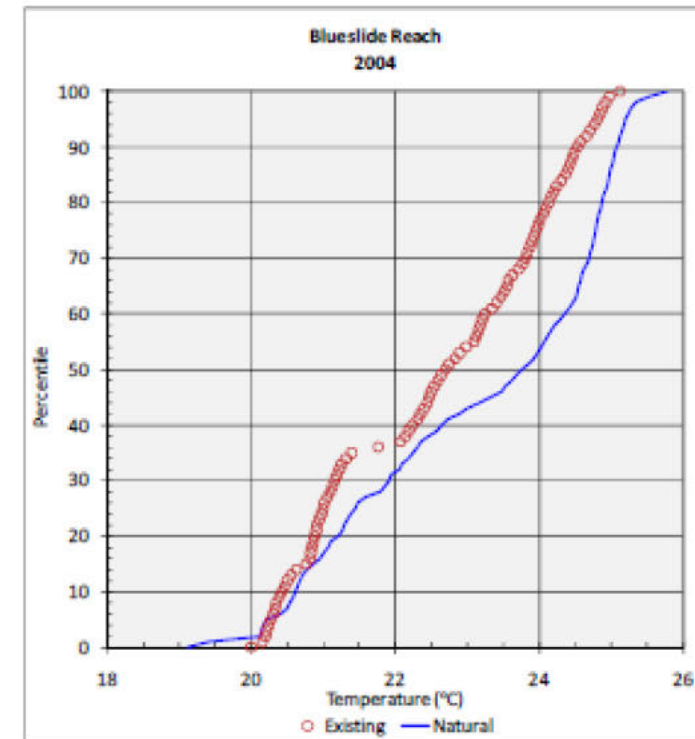
Lowest
temp

1	19.41	18.58	-0.83
2	19.98	19.07	-0.91
3	20.16	20.05	-0.10
4	20.19	19.90	-0.29
5	20.37	20.17	-0.20
6	20.39	20.55	0.16
7	20.43	19.75	-0.69
8	20.43	19.27	-1.17
9	20.51	19.52	-0.99
10	20.55	19.87	-0.68
11	20.60	20.50	-0.11
12	CFA ANALYSIS		-0.60
13			-0.89
14	21.11	20.03	-1.09
15	21.19	20.52	-0.67
16	21.31	20.57	-0.74
17	21.39	20.53	-0.86
18	22.25	20.88	-1.38
19	22.44	21.95	-0.49
20	22.59	21.78	-0.81
21	22.90	21.37	-1.52
22	22.96	21.80	-1.16
23	23.28	21.83	-1.45
24	23.43	21.97	-1.47
25	23.46	22.26	-1.20
26	23.52	22.08	-1.45
27	23.60	22.72	-0.88
28	23.62	22.69	-0.93
29	23.64	22.52	-1.12
30	23.71	21.85	-1.86
31	23.83	22.71	-1.12
32	24.09	22.74	-1.35
33	24.20	22.82	-1.39



TMDL uses maximum
difference for all ranked pairs

Highest
temp



CFA plots

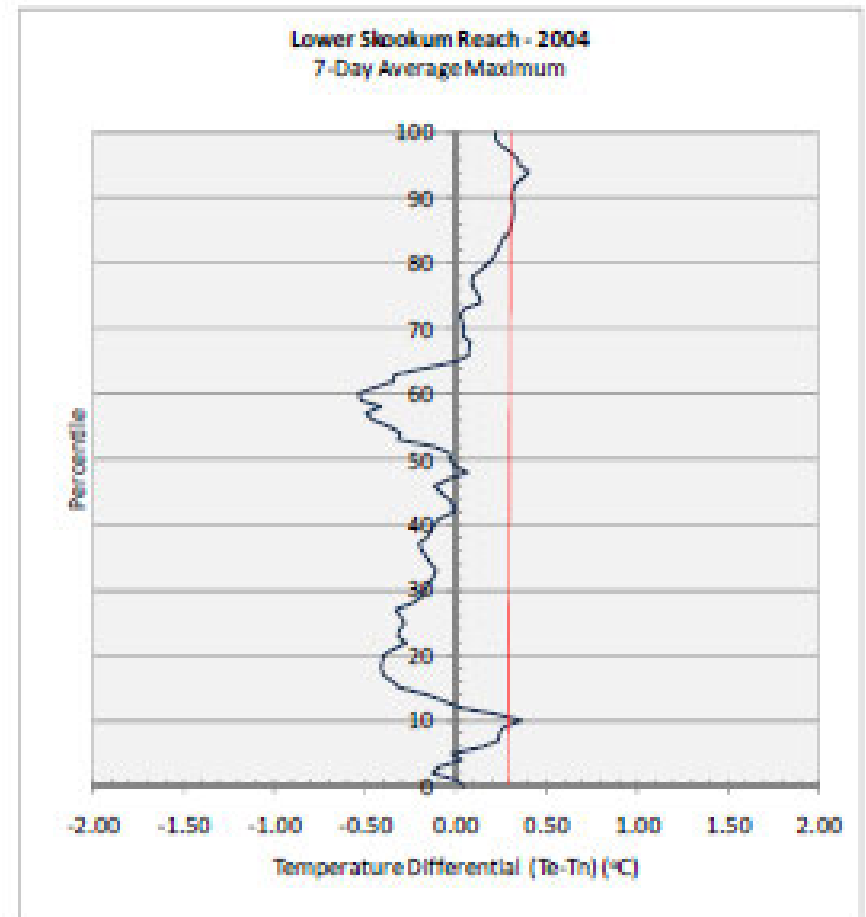
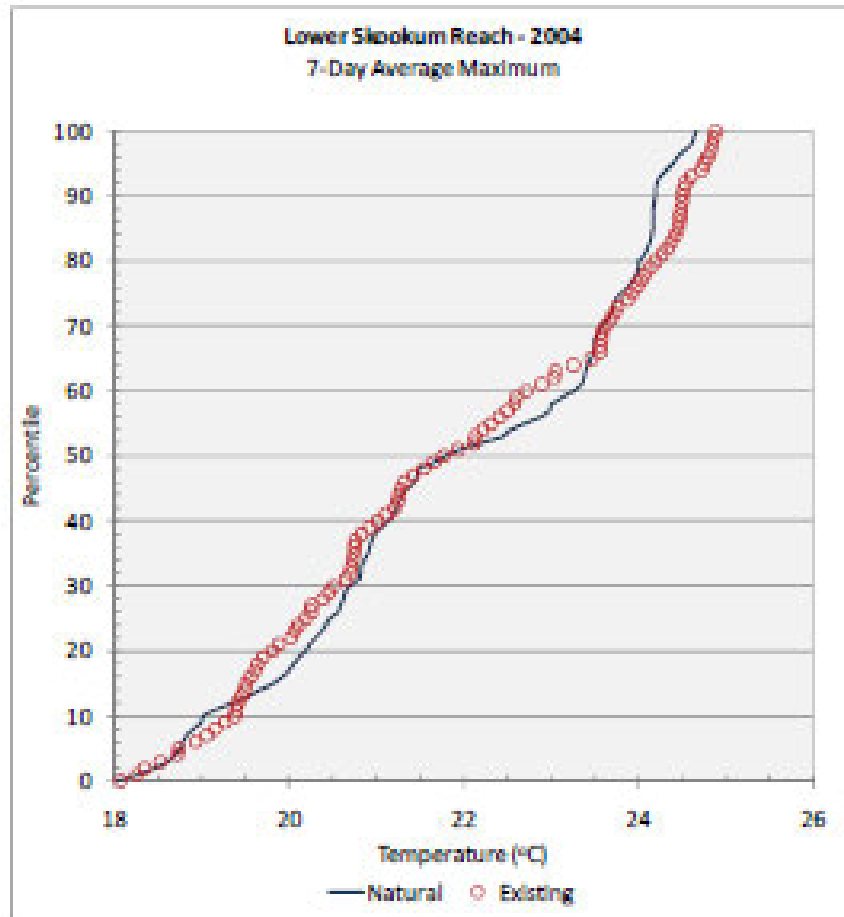
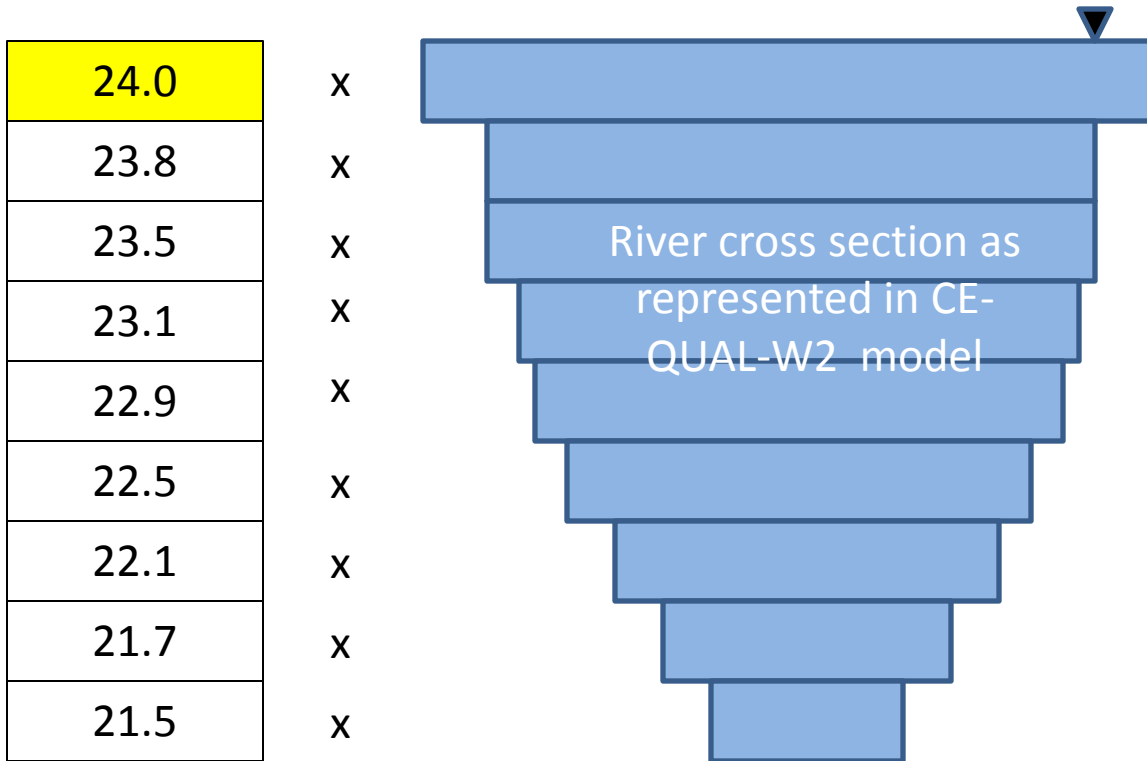


Figure 20. Segment 115 cumulative frequency distribution of the 7-day average of the daily maximum temperatures along with the associated temperature differential. Analysis includes the natural and existing conditions observed at lower Skookum reach (segment 115) in 2004.

Volume Averaging

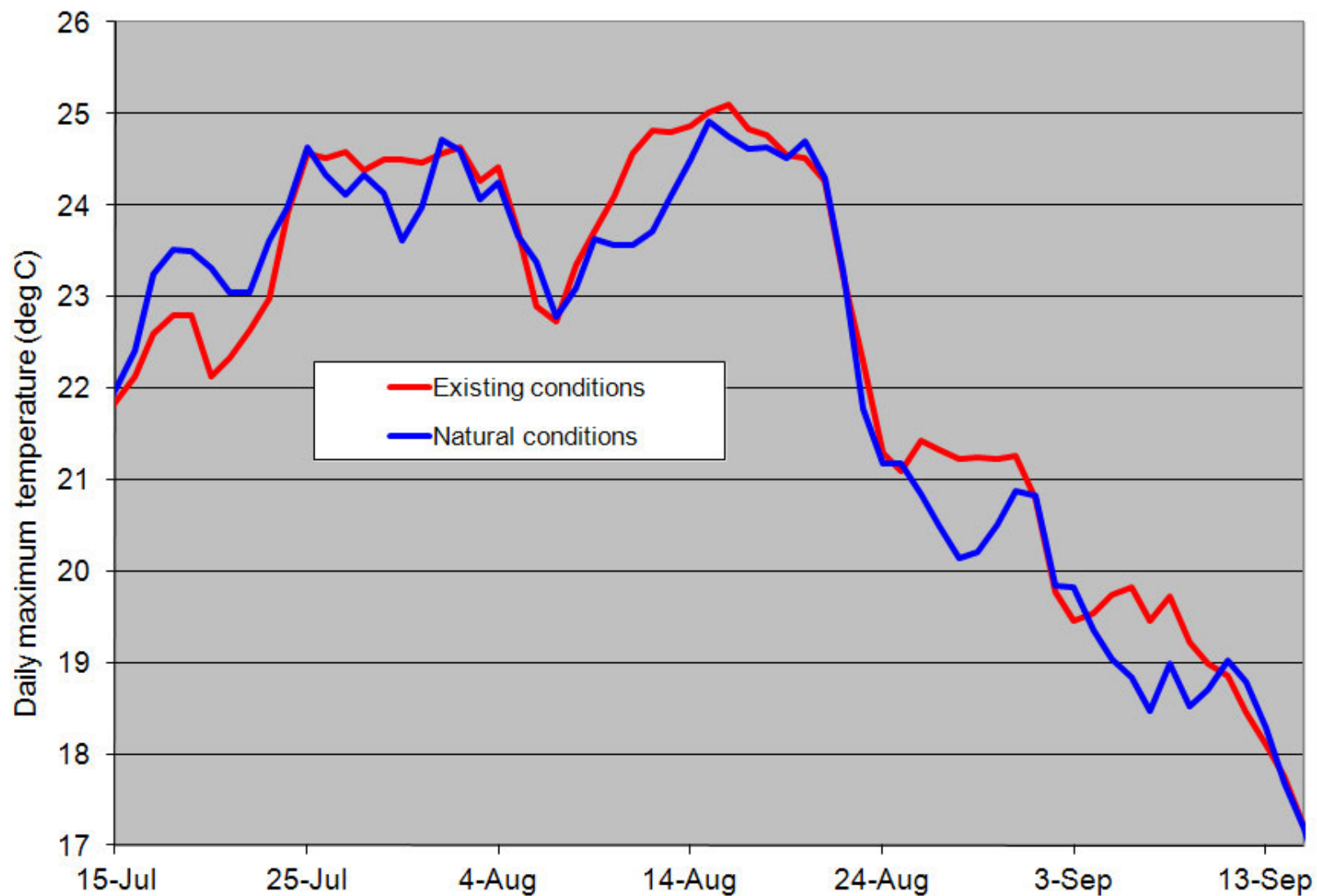
Sum of (cell temp x cell volume)/(total volume) = volume-weighted average temperature



- Surface cell has greater volume than bottom, represents more habitat
- Volume-averaging used to get a single value that best represents water column as a whole
- Changes magnitude of estimated impairment

Attainment of Tribe's WQS Using CFA

Comparison of temperatures under existing and natural conditions at the upstream end of the Kalispel Tribe's reservation (River Mile 72)



Use of CFA in TMDLs - An Incomplete List

- Willamette River Temperature TMDL, OR, 2006
- Florida Mercury TMDL, 2012
- Commonly used in bacteria TMDLs in many states including, CT, HI, ND, DE, NC, NJ, OR, AZ, TN, TX
- Stockton Deep Water Shipping Canal Dissolved Oxygen TMDL, CA, 2005
- Muddy Creek and the Yadkin River Turbidity TMDL, NC, 2011
- Upper Clinch Watershed pH TMDL, TN, 2009
- Potomac Estuary PCB TMDL, DC, 2007
- Lake Elsinore and Canyon Lake Nutrient TMDL, CA, 2005
- Buckhannon River pH and metals TMDL, WV, 2010
- Indian Creek, Southampton Creek Paxton Creek and Goose Creek and Sawmill Run Watersheds total phosphorus and sediment TMDLs, PA (Issued by EPA) 2008
- Ridenour Lake Metals TMDL, WV,

